NORTHSTAR PLANNER

Product Description
Juniper Networks® NorthStar Planner is a network modeling tool that can be used for offline visualization and detailed architectural planning of any production network. NorthStar Planner enables network operators to forecast the impact that changes such as latency, additional traffic, shifts in traffic flows, and new capacity or services will have on their network.

An intuitive graphical interface provides concise and in-depth views into routed networks and helps optimize bandwidth and network resources. Using NorthStar Planner’s global network topology view, operators can model and visualize dynamic, explicit routing paths, designed to operate within end-user defined constraints.

By collecting data through dynamic topology or label-switched path (LSP) data acquisition, NorthStar Planner can generate a graphical view of a network, enabling the addition, removal, and reconfiguration of network elements. The effects of these changes and other traffic scenarios can be simulated without affecting the production network. Simulations can be run on demand in an interactive mode to assess the network for potential failure scenarios.

Architecture and Key Components
NorthStar Planner is an integrated software package that can be used for network topology design and simulation across multiple network domains using different network elements.

NorthStar Planner designs, simulates, and analyzes networks without affecting the network itself.

- **Design:** NorthStar Planner offers the ability to construct network topology maps showing simulated or imported data for nodes, links, and LSP paths. It offers a one-off capability to import or add nodes, links, and LSPs for network modeling, and can also add/stage LSPs for provisioning to the network.

- **Simulate:** NorthStar Planner allows you to create or schedule simulation events to analyze the network model based on failure scenarios such as link congestion, broken link, unresponsive node, and more.

- **Analyze:** The Report Manager feature provides extensive reports for simulation and planning. NorthStar Planner imports interface data or aggregates archived data to generate historical statistics for querying and chart displays.

NorthStar Planner imports network state and topology information from NorthStar Controller, an SDN controller that provides granular visibility and control of IP, IP/MPLS, and segment routed flows. This helps simulate live production networks that are controlled by NorthStar Controller, and it allows NorthStar Planner to run simulation tests offline without affecting the live production network.
The main components of NorthStar Planner include the following.

**Main and Topology Window**

The main window provides the topology view, configuration wizards, the console, toolbars, and network information. The topology (map) view, which is in the main work area for any network model, is loaded into the system as shown in Figure 3. Multiple links displayed between nodes use “line bending” to avoid hidden trunks in the topology, which incorporates collapsible node aggregation views. Node locations can be viewed with their geographic coordinates on the world map or automatic layouts.

The topology view displays important link and node properties. Links are color-coded based on utilization. Alternatively, links can be viewed by other properties such as media, trunk type, vendor, or domain/area. Nodes are color-coded by symbols, icons, or vendor types. Path analysis, performed in the topology view, displays detailed path information between any two nodes found in the network based on factors such as routing method used, reserved and actual bandwidth allocation, link distance, or oversubscription.

**Import Network Wizard**

The import network wizard allows you to import different types of network configuration data into the software. This process creates a corresponding network project specification file, which is saved into the user-specified output directory and automatically loaded into the program.

**File Menu and File Manager**

The file menu option includes browsing options such as Create Network, Open Network Browser, Open File Manager, Import Network Wizard, and more. The File Manager lets you easily navigate through directories to find and load network projects (specification files), open and edit files, and create new files in NorthStar Planner file format.

**Key Capabilities**

**Construct Network Topology Automatically**

NorthStar Planner collects data snapshots of live networks from NorthStar Controller, leveraging the tight integration between the two tools. Additionally, NorthStar Planner can source data from stored network configuration files and other optional data sources, leveraging these data sources to construct accurate network topology views for multivendor networks that are fully aware of protocols, layers, autonomous systems (AS), areas, VPNs, and more.

**Perform Traffic Load Analysis**

NorthStar Planner users can access, view, and assess current and historical traffic data to pinpoint bottlenecks or underutilized links at a glance from the topology map.

**Perform Capacity Planning**

NorthStar Planner facilitates decisions about future network expansion by studying the impact of potential changes before they are implemented. The system can be used to determine whether there is sufficient capacity or if more should be added, as well as which links can be pruned without compromising resiliency.
Ensure Network Resiliency Against Failure
NorthStar Planner users can study the impact of extensive node, link, site, card, and Shared Risk Link Group (SRLG) multilayer failure scenarios, analyzing how traffic is rerouted and its effect on network links (e.g., worst-case trunk utilization). They can even perform exhaustive single, double, and triple failure tests.

Identify and Prevent Potential Bottlenecks
NorthStar Planner provides insights into why traffic flows or tunnels fail to route, and it identifies which trunks will become congested under certain failure or what-if scenarios.

Automate Low Cost, Robust Network Designs
NorthStar Planner automatically determines where to add links to satisfy traffic for resiliency against any failure scenario. A network can be designed from scratch or on top of an existing network configuration. Tariff or pricing data can be imported for least-cost topology designs.

Validate Changes Prior to Deployment
NorthStar Planner lets you validate day-to-day network changes, or model and simulate network migration, network expansion, or the merging of multiple networks. This allows you to analyze the impact of these changes in a safe, virtual environment while experimenting with changing parameters, protocols, and topologies.

Design and Simulate Segment Routing and MPLS-TE, LSP Routing
With NorthStar Planner, users can design and simulate segment routing (SR) paths and IP/MPLS LSP tunnels via intelligent MPLS LSP and SR-TE path calculations. They can also perform network outage simulations across SR/MPLS and IP layers, automate fast reroute (FRR) backup tunnel design and simulation, automate the design of diverse paths for primary and backup protection tunnels, and optimize paths that have become suboptimal over time.

Create and Model VPNs
NorthStar Planner lets you model a wide variety of VPNs and simulate VPN routing. You can use the system to generate VPN traffic and then simulate a card failure to see if it will bring down the VPN. You can also run VPN-specific integrity checks on the configuration files.

Model and Analyze BGP
NorthStar Planner users can study BGP routing, perform detailed BGP routing analysis and what-if studies involving BGP policy changes or the addition of new BGP peers, and perform detailed BGP neighbor analysis.

Analyze CoS to Meet SLAs
To ensure that they are meeting SLAs, network operators can use NorthStar Planner to model class of service (CoS) classes and policies, as well as different queuing schemes. They can also define application flows based on CoS, which enables the modeling of voice over IP (VoIP) or video on demand (VOD). NorthStar Planner also analyzes packet loss and delay statistics per class of service.

Simulate Multicast
With NorthStar Planner, users can simulate multicast flows based on user-defined multicast groups and demands. They can also simulate the effect of rendezvous point selection on the distribution tree and on link utilization, as well as shortest-path tree (SPT) switchover.

Features and Benefits
NorthStar Planner lets network operators import their existing network configuration or build a new network from scratch. Network modeling and simulation capabilities enable you to optimize network bandwidth and latency, as well as network resource management for the most efficient use of network infrastructure.

NorthStar Planner also helps network operators effectively manage network costs. An inventory management tool, which facilitates the optimization of network infrastructure, helps design networks based on available resources, collecting and analyzing network data for producing network health audits. For example, NorthStar Planner checks whether device configurations are accurate and comply with operator-defined specifications, eliminating the potential for manual network errors.

Benefits of the NorthStar Planner
- **Reduce network costs**: Effective designs can result in lower hardware and maintenance costs. NorthStar Planner features tariff-based design, MPLS LSP, and SR traffic engineering for effective utilization of the network, and superior design optimization.
- **Automate for productivity and operational efficiencies**: With NorthStar Planner, tasks such as reporting, topology maps, and LSP path generation are automated, as well as tasks such as accommodating traffic growth and optimizing the network topologies.
- **Guard against unnecessary risk**: Assessing the network using planner’s resiliency analysis, fiber cut analysis, etc. helps operators avoid problems and mitigate risk.
- **Diagnose performance problems**: Using NorthStar Planner’s flow analysis, bottleneck detection and analysis, peak utilization analysis, discrete event simulation, and multicast simulation features helps administrators quickly diagnose performance problems.
- **Validate changes prior to deployment**: NorthStar Planner enables designers and administrators to validate new services, equipment, and technologies before they are rolled out.
- **Plan for future growth**: Using NorthStar Planner’s superior capacity planning and data forecasting helps inform and optimize plans for growing the network to meet business needs.
**NorthStar Planner Feature List**

<table>
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<tr>
<th>Features</th>
<th>Description</th>
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<tr>
<td>Capacity planning, backbone design, and diversity design</td>
<td>The impact of adding new demands, or traffic, can be analyzed in a network model before they are deployed on the real network. The software determines whether there is sufficient available capacity in the network and recommends places where capacity should be added. A network can be automatically designed based on end-to-end traffic requirements, starting from an existing set of backbone trunks (&quot;Incremental Design&quot;) or from scratch (&quot;Greenfield Design&quot;). Using powerful heuristic algorithms, NorthStar Planner can evaluate whether trunks can be pruned from the network without compromising diversity constraints. Trunks can be optimally added to ensure all traffic is placed under any single element failure (&quot;Diversity Design&quot;). Potential bottlenecks are also easily detected. Further analysis capabilities include load balancing and end-to-end delay and loss calculations.</td>
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<td>Failure simulation</td>
<td>Exhaustive single-, double-, or triple-element failures, interactive or customizable scripted failure scenarios can be simulated to analyze and evaluate a network's resiliency.</td>
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<td>Hardware-specific device library</td>
<td>Hardware-specific device models have been developed through close working relationships with major device vendors. This ensures the accuracy and precision of the model, as well as the support of many device-specific features. NorthStar Planner includes various data extraction tools to convert network data (for example, router configuration files) into a format readable by NorthStar Planner.</td>
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<td>Path assignments</td>
<td>For an existing backbone network, an optimal layout or path assignment can be determined that satisfies all demand constraints, which may include media preferences, diverse paths, hardware bandwidth overhead calculations, and delay/hop constraints. In the case of routers, tunnel constraints may include link attributes/colors and capacity. Available paths can be found even when the hardware fails to find a path. If the hardware switch supports user-specified paths, then paths found using the model can be downloaded to the real network.</td>
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<td>Tariffs</td>
<td>NorthStar Planner can help reduce private line leasing costs (monthly recurring and nonrecurring components) by producing designs that satisfy user requirements and constraints while maintaining minimal cost. You can specify your own pricing tables, which are then integrated into NorthStar Planner suite to price out lines. This is used extensively in the program's heuristic least-cost design algorithms. The savings normally translate into a quick return on investment.</td>
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<td>Detailed design and analysis reports</td>
<td>As with all modules, detailed reports are generated to help you quickly assess and summarize network-related data. These reports include trunk pricing, trunk utilization, and demand paths. Reports can be generated in text format, CSV (comma separated) format, or web-friendly HTML.</td>
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<td>Detailed Topology Views</td>
<td>Detailed topology views allow you to view your network nodes and links. These can be organized by geographical location, rearranged by hand, or automatically rearranged in a format that distributes points to make the network easier to view. Panned or web-friendly HTML.</td>
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<td>Discrete event simulation</td>
<td>Packet-by-packet simulation is available for Frame Relay and router device models, providing statistics on queueing delays and packet loss ratios.</td>
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<td>Domain/structured networks</td>
<td>Partitioned or structured networks, including private network-to-network interface (PNNI), are supported by NorthStar Planner. Device-specific domain support is also correctly modeled.</td>
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<td>Traffic load analysis</td>
<td>Analysis of real traffic load per demand can be loaded into the software model to obtain a more accurate link utilization for failure simulations. NorthStar Planner can do multiperiod load and performance analyses.</td>
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<td>Facility feature</td>
<td>Any number of nodes and/or links can be grouped in a facility for failure scenarios and reporting options.</td>
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<td>Class of service (CoS) feature</td>
<td>The CoS feature lets you divide traffic into four classes, including strict priority. With this feature, the accuracy of the NorthStar Planner’s Design and Discrete Event Simulation modules are greatly improved, as the software takes into account all the details of class-based weighted fair queuing (CBWFQ) in its routing process.</td>
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<td>Customer tariff</td>
<td>The customer tariff feature allows you to specify various tariff classes and their rates for the network. Each node is associated with a particular tariff class. All links are then priced according to their service and the classes of the nodes they connect.</td>
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<td>Path diversity design</td>
<td>The path diversity design feature allows you to configure demands (or tunnels) on link-disjoint, site-disjoint, or facility-disjoint paths.</td>
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**Specifications**

**Supported Protocols and Technologies**

**Interior gateway protocol (IGP)**

- Modeling of OSPF, IS-IS, Extended IGRP (EIGRP), Interior Gateway Routing Protocol (IGRP), and RIP routing protocols
- OSPF two-layer hierarchy (backbone area and areas off the backbone area)

- Routing metric modification by modifying variables like the cost, reference bandwidth, interface bandwidth, and delay, according to each routing protocol's metric calculation formula

**Equal-cost multipath (ECMP)**

- Path analysis displaying ECMP routes between two nodes
- ECMP report listing ECMP routes in the network
- Load balancing by splitting flows into sub flows with equal-cost paths
Static routes
- Extraction of static route tables
- What-if studies upon adding or modifying static routes

Policy-based routing (PBR)
- Extraction of PBR details (access list, policy route map)
- What-if analyses by modifying the policy to use on an interface

Border Gateway Protocol (BGP)
- Extraction of BGP speakers, autonomous system (AS) numbers, peering points for both IBGP and EBGP, route reflectors, BGP communities, weight, local preference, multi-exit discriminator, AS_PATH, and BGP next hop from router configuration files
- Key integrity checks such as finding BGP unbalanced neighbors and checking IBGP mesh connectivity
- Implementation of the BGP route selection rules and bottleneck analysis to troubleshoot routing failures
- BGP attribute modification for what-if studies
- BGP map logical view of EBGP and IBGP connections

Virtual private network (IP VPN)
- Modeling of MPLS VPNs such as L3 VPN, L2 Kompella, L2 Martini, L2 CCC, and virtual private LAN service (VPLS)
- VPN extraction from router configuration files
- VPN topology display and reports
- VPN-related integrity checks
- Design and modeling of VPN via a VPN wizard
  - Adding of VPN traffic demands
  - VPN monitoring and diagnostics (when used in conjunction with the online module)

Class of service (CoS)
- Extract CoS classes and policies from router configuration files
- Create and modify CoS classes and policies and assign policies for link interfaces
- View Link and Demand CoS reports and link load reports by CoS policy

Multicast
- Create, view, and modify multicast groups
- Create multicast demands and analyze their paths
- Protocol Independent Multicast (PIM) modes including sparse mode, dense mode, bidirectional PIM, and source-specific multicast (SSM)

VoIP
- Define H.323 media gateways/gatekeepers, Session Initiation Protocol (SIP) user agents/servers, and codecs
- Perform a call setup path analysis and view a report of call setup delays
- Use the traffic generation wizard to generate traffic starting from Erlangs

OSPF area design
- Design the backbone network based on the following settings:
  - Specify which nodes to use as gateways and the areas accessible to this gateway
  - Specify administrative weights to be used for designed links from the Admin Weight feature

MPLS tunnels for traffic engineering (TE)
- Path placement
  - Routing of LSP tunnels over physical links
  - Routing of traffic demand flows (forwarding equivalence class [FEC]) over LSP tunnels and links
- Modification
  - Modification of LSP tunnel preferred/explicit routes and media requirements (bandwidth constraints, QoS requirements, priority and preemption, affinity/mask, and include-any/include-all/exclude admin-groups)
  - Addition of secondary/standby routes
- Net grooming
  - Network grooming of tunnel paths configlet generation
  - Configlets created based on added and modified tunnels
  - Templates can be specified
- Path diversity design
  - Design primary and secondary/standby tunnel paths to be link-diverse, site-diverse, or facility-diverse
  - View or tune the resulting paths

MPLS fast rereoute (FRR)
- Specification of tunnels requesting FRR protection and FRR backup tunnels
- Simulation of routing according to FRR during link failure
- Design of FRR backup tunnels for LSP tunnels requesting FRR protection according to site or facility diversity requirements

Interarea MPLS-TE
- Design LSP tunnels between different OSPF areas for multi-area networks

Differentiated Services (DiffServ) TE tunnels
- Create and model Juniper Networks single-class and multi-class LSPs
- Configure bandwidth model (RDM, MAM) and bandwidth partitions
- Define scheduler maps (CoS policies) and assign them to links
Supported Platforms:

- Juniper Networks:
  - Junos® operating system and JunosE-based devices, such as Juniper Networks® EX Series Ethernet Switches, MX Series 5G Universal Routing Platforms, J Series, M Series, T Series routers
- Cisco Systems:
  - IOS and IOS-XR-based devices such as 7500, GSR12000, and CRS-1
  - MPLS/tag switching (MPLS-TE, GB-TE) routers
- Alcatel
  - 7750 Service Router
- Huawei
  - AR Series Routers
- NE Series Routers

System and Operating Environment Recommendations

- **Hardware:** 64-bit dual x86 processor, minimum memory 16 GB RAM (quad-core x86 with 32 GB or more of memory recommended)
- **Storage:** 1 Tb Serial Advanced Technology Attachment (SATA), Serial Attached SCSI (SAS), or solid-state drive (SSD); Volume storage: 2 disks with 2 TB SATA
- **Network:** 1/10 GB interface card (2)
- **OS:** Linux OS (CentOS 6.4, RHEL 6.4) with kernel-based virtual machine (KVM) support

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit [www.juniper.net/us/en/products-services](http://www.juniper.net/us/en/products-services).

Ordering Information

This product adheres to the Juniper Software Advantage pricing model. Please be advised of the following items that constitute an order:

- As this is a virtual appliance/software product, you would not buy any hardware license from Juniper.
- Instead, you would procure the hardware and additional required support for this hardware from a third-party vendor.

For additional information on supported hypervisor(s) and VM requirements and recommended hardware configuration, please refer to the technical documentation for this product on our website ([www.juniper.net](http://www.juniper.net)) under the support section.


About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.